# REPORT OF SESSION ON BAITFISH TRANSPORT, HOLDING, AND SUBSTITUTE

Chairman: Tamio Otsu
Rapporteur: Richard N. Uchida

A. References

WP/BT/3, WP/BT/4, Various memos to the Director, Honolulu Laboratory reporting on the progress of the baitfish transport project.

B. Discussion

In opening the discussion, the chairman stressed the need to establish directions and guidelines for future work in transporting live bait from one locality to another. The scarcity of live bait to carry on pole-and-line fishing is not unique to the Hawaiian skipjack tuna fishery. Several other island groups in the central and western Pacific, now contemplating the development of a viable fishery for skipjack tuna, also face the problem of obtaining sufficient amounts of bait on a sustained basis.

It was pointed out that there were several alternatives to solving the bait problem. These were

1. to supplement existing natural stocks of live bait by culturing other species of baitfish,
2. to develop some type of artificial bait, and/or
3. to move large quantities of baitfish from areas of abundance to areas of scarcity.

The Honolulu Laboratory of the Southwest Fisheries Center, National Marine Fisheries Service has been actively involved for the past few months in attempting to develop the technology needed for transporting live anchovy (Engraulis mordax) from California to Hawaii. A preliminary study of the various options available for moving quantities of anchovy on a regularly scheduled basis indicated that the most feasible method was to develop a transport tank with a self-contained life-support system, and one that could be transported across the ocean in a relatively short time. A surplus 5,000-gallon aircraft refueling tank was acquired and converted into a bait transport tank.

Problems encountered in two trial shipments of anchovy were discussed at length. Of primary concern was the heavy mortalities incurred in both shipments, most of which occurred between the time the anchovy were loaded into the tank and the time the tank was loaded on the Matson Roll on/Roll off freighter. Estimates placed the survival rate of anchovy arriving in Honolulu at 45%-50%, a far cry from an unqualified success. Discussions also brought out that the "vacuum cleaner" system (siphon) installed after the first shipment to remove dead bait from the tank was also removing significant quanities of live fish. In order to reduce the suction in the system, the "linear" vacuum was modified to a "cone head" vacuum. The tank was then shipped back to California for a third trial shipment. On the third

shipment, the strategy was to load the bait into the tank as close to the freighter's sailing time as possible, in order that the tank could be tied into the ship's water system from the very outset. In this way, it was hoped that the better-quality oceanic water flowing through the system would reduce the initial mortality that seriously plagued us on the first two trials.

Discussions then centered around the importance of "aging" the bait before they are transported. California bait dealers as well as Japanese bait dealers uniformly experience about a 30% "initial" mortality; or mortality of bait attibutable to stress of capture. Some bait would die regardless of how carefully they may be netted and handled. Bait dealers find that after this initial mortality, survival can be greatly increased by the process of "aging" the bait. This involves holding the baitfish in receivers over a minimum period of a week during which time weak fish are eliminated and the survivors are generally strong enough to withstand considerable stress of confinement in baitwells, or presumably in our transport tank. Japanese long-range skipjack tuna fishermen are finding that by purchasing strong "aged" bait, they are able to go to distant equatorial waters with relatively low mortality since these fish are better able to withstand abrupt temperature changes that would have deleterious effect on "green" bait.

Because of the importance of aging, the group decided that the strategy for the third trial shipment should be changed. Some means of aging the fish before transport must be found. Suggestions included:

1. asking bait dealer in Long Beach to age bait for us,
2. add smaller quantities of anchovy into the tank (perhaps about 400 pounds) on each day for about three or four successive days, each day weeding out the dead fish.

In this way, we would end up with a core of stronger "aged" bait in the tank. The Honolulu Laboratory personnel agreed to change our strategy to comply with the group's suggestions.

At this point the Chairman asked the group for a frank appraisal of the Laboratory's bait-transport project, of whether or not we were going about this problem in the right way. The responses were heavily in favor of the project, and of the approaches used. However, it was agreed that at this stage, we should probably not start into modifying a second fuel tank (already available) into a second transport tank. Another trial shipment should provide a better basis on which to decide whether or not this particular tank would be worth developing further. In the meanwhile, however, some design studies should be started to see whether other tank configurations may not be better. It was agreed that tanks designed specifically

to carry fish would certainly meet our needs better, but that cost factors would have to be taken into consideration. One suggestion was that a circular or oval tank, 7-8 foot in diameter and constructed of 1/4" stainless steel may be placed on a 40-foot flatbed trailer and be transported on the Roll on/Roll off freighter. Such a tank may have a water capacity equivalent to the present transport tank. Another suggestion was that, rather than a single large tank, five separate circular tanks could be constructed and placed on a flatbed trailer. These individual tanks could be tied together in a series so that a single pump unit and a manifold system could supply the proper life-support throughout. The advantage in the latter would be that each tank could be lifted off the trailer individually and be placed into a holding tank to allow the fish to swim out, thus reducing bait handling considerably.

Mr. Puffinburger agreed to work with the Honolulu Laboratory personnel in getting cost estimates for constructing such tanks. Design studies will be initiated immediately.

Further discussions centered around the various problem areas that have come into focus since the start of our experiments. One is that the Matson freighters are presently limited to carrying two tanks on each sailing (this limitation is imposed by the ship's water system). Another was in Matson's schedules. Presently two roll on/Roll off ships, the

LURLINE and the MATSONIA are making round trips between Los Angeles and Honolulu. Future plans are for Matson to get into a three-point schedule, with ships touching at Oakland, Los Angeles and Honolulu. When this triangle route is adopted, this may affect our transport scheduling seriously. Another problem was with the availability of "proper sized" baitfish. The Hawaiian fishermen feel that the anchovy returned to Honolulu in the first two trial shipments were too large and they would prefer anchovy about 3-4 inches in overall length. Mr. Everingham and others mentioned that the smaller "pinhead" anchovy are abundant during the summer months. These pinheads are reputed to be weak, but it was stated that after aging, these are actually quite hardy. Such pinhead anchovy would serve the Hawaiian fishermen well.

Concerning the economics of baitfish transport, reference was made to data summarized in WP/BT/4. It was pointed out that the break-even cost per bucket of anchovy, shipped to Hawaii under various combinations of mortalities and ultimate load of survivers (Tables 8-10) was in the general range where this transport-system may be economically feasible if further developed. This would mean the addition of more tanks in the future in a full-scale system, perhaps with two tanks of fish coming across every few days especially during the summer months.

The development of the bait-transport hardware and the various experiments conducted on carrying density, logistics of the system, etc. would be of immediate application to the Hawaiian skipjack tuna fishery, but the resulting findings would be equally applicable to fisheries located elsewhere, such as in American Samoa, Trust Territory, Guam, etc. For example, bait for Guam may possibly be transported from the Philippines.

It was emphasized that the bait-transport system is primarily to augment the available natural stocks of nehu in the Hawaiian fishery. Transported bait may enable fishermen to

1. range farther during Hawaii's off-season because these anchovy are hardier baitfish,
2. may enable new boats to join the Hawaiian skipjack tuna fleet once availability of baitfish is no longer a constraining factor,
3. may enable reduction in crewsize on Hawaiian boats since the number of fishermen may not necessarily be regulated by manpower needed to catch own bait, and
4. would greatly increase flexibility of operations, where fishermen no longer need to rely so heavily on the fluctuating supply of nehu.

Bait-transport by tanks, though important in itself, may not be considered the single alternative to solving Hawaii's problems. A full-scale system may include in addition, baitboats to

haul anchovy during the eastern Pacific off-season (also off-season here in Hawaii). In any case, other alternatives must always be considered.

In summary, it was pointed out by tuna industry representatives that future purse seining trials in the central and western Pacific will probably involve a compromise between the use of live bait and purse seine. Bait will probably be used to chum and hold the schools while the purse seine is set. Therefore, live bait will continue to be an important part of fishing for surface schools of tuna, regardless of the gear used. It was brought out that it is vitally important to develop a workable bait transport system immediately so that the knowledge gained and expertise acquired from the trial shipments could be used in the future.

Participants attending the sessions on Natural Stocks and on Baitfish Transport, met together to discuss problems involved in bait survival and handling. It was pointed out that proper handling of bait during capture and during transfer from net to baitwell could reduce mortalities significantly. Stick-held dip net to capture bait at night was found to be superior to seines in reducing mortalities during capture. Transferring bait from net to baitwells during daylight hours also reduced mortalities substantially. Stolephorids showed less avoidance when they were being induced from the net into blue-colored buckets. However,

they obviously showed strong avoidance towards red or yellow buckets. One of the most significant results obtained in experiments conducted in Papua New Guinea was that bait mortalities could be reduced substantially by transferring about 0.8 kg (1.75 pounds) of bait at a time in a 4-gallon bucket..

Discussion also brought out that a new vessel, designed for use in Trust Territory waters, incorporates a system of transferring bait without the use of buckets or scoops. The system involves the use of small openings cut into the hull of the vessel below the water lines. Bait caught and held in nets can then be induced to swim into the baitwells by use of lights and currents. A quite similar system is already being used by Mr. Everingham in San Diego.

C. List of participants

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